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Vowel-Pitch Matching, from Senta to Kundry

Richard Wagner (1813-1883) stands out distinctly from most other composers because he wrote both the musical scores and the libretti for his operas. His libretti are considered to be masterworks in their own right and Wagner was keenly interested in ensuring that the words he had written were intelligible to opera audiences. A common practice among sopranos which may work against intelligibility, is to modify vowels to achieve uniformity of tone, which works well when words are not present. When composers set a libretto to music, the vowels may not work well with the corresponding notes, especially if the frequency of the vowels differs from the frequency of the pitches. However, when a pitch frequency and a vowel frequency match or are close in proximity, the voice is not only boosted in volume, but also the intelligibility increases.

Previous research indicates that Wagner purposefully matched vowels to pitch in order to enhance declamation. Furthermore, Wagner increasingly utilized vowel-pitch matching as he gained experience as a composer. There is no evidence that Wagner consciously set his libretti to enhance the intelligibility of the soprano voice, however researchers John Smith and Joe Wolfe identified a demonstrated preference for vowel-pitch matching in Wagner's operas featuring the soprano roles of Brünhilde and Isolde (1854 -1874).[1] The present study seeks to determine if Wagner's preference for vowel-pitch matching could be demonstrated in soprano roles composed before and after Brünhilde and Isolde. For the purpose of this comparison, the soprano role of Senta from *Der Fliegende Holländer* (1840) and the soprano role of Kundry from *Parsifal* (1882) were selected for evaluation.

[1] John Smith and Joe Wolfe, "Vowel-pitch matching in Wagner's operas: Implications for intelligibility and ease of singing." *The Journal of the Acoustical Society of America*, 125, EL196, (2009): 1, accessed February 20, 2018, https://doi.org/10.1121/1.3104622, 2.

Whether Wagner's vowel-pitch matching efforts were conscious or unconscious, the composer expressed admiration for good singing as early as 1829. At an early stage in his career, Wagner was greatly inspired by the soprano Wilhelmine Schroder-Devrient, who he allegedly imagined singing a life-altering performance of Leonore in Beethoven's *Fidelio*.[2] Eventually, the soprano did sing the role of Senta in Wagner's *Der Fliegende Holländer*.[3] In 1837 Wagner wrote his essay *Bellini* which celebrated "the italianate capacity for bel canto expressiveness."[4] Wagner's established respect for singers and the principles of good singing laid out by the Italians in the 18th century influenced the composer's vocal writing. Therefore, Wagner would have preferred a singing style that combined "Italian training" with "a clear and expressive enunciation of German text."[5] Though Wagner vehemently opposed the vocal exhibitionism that reigned supreme in Italian opera, his work as a Kapellmeister inspired him to "appreciate the dramatic possibilities inherent in melody."[6] Following his musical experience in the church, Wagner developed "a syllabic style carried on continuous melody, [which] put the emphasis on a singer's sustaining powers."[7]

According to Desmond Shawe-Taylor, "what Wagner required of his singers was pretty much what most twentieth-century composers have usually demanded: beautiful tone, clear enunciation, a firm vocal line, and precision in musical detail."[8] Wagner admired good singing. Yet, "his contemporaries and subsequent generations of musicians have complained...that the

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[2] Barry Millington, John Deathridge, Carl Dahlhaus, Robert Bailey, Elizabeth Forbes, Christa Jost, and Paul Sheren, "Wagner family," *Grove Music Online*, accessed April 14, 2018. https://doi.org/10.1093/gmo/9781561592630.article.29769-2001-10-31

[3] Desmond Shawe-Taylor, "Wagner and His Singers" in *Wagner in Performance*, eds. Barry Millington and Stuart Spencer. 15.

[4] Millington, "Wagner Family," *Grove Music Online.*

[5] Neil Howlett, "On Singing Wagner," in *Opera,* 36-38.

[6] Ibid., 38.

[7] Ibid., 39.

[8] Shawe-Taylor, "Wagner and His Singers," 15.

unprecedented demands made by his works in performance did much to strain and even ruin the very kind of singing...that he most admired."[9] According to Neil Howlett, the demands that Wagner placed on the singers were especially problematic for singers with "lighter voices" as well as those who did not have the stamina or power to compete with the orchestra, which Wagner essentially elevated to a position of equality with the voice.[10]

Beginning with *Rienzi* (1842), Wagner's writing for the lead tenors and sopranos severely tested the vocal stamina of the singers.[11] According to Shawe-Taylor, "until recently," it was common practice to make "substantial cuts" in Wagner's operas, to make the roles more manageable, especially in *Tristan und Isolde*.[12] Sopranos including Lillian Nordica, Lilli Lehmann, and Nellie Melba were reported to have excelled in performing some of Wagner's heavier works in addition to "lighter French and Italian roles." These observations suggest that Wagner may have incorporated vocal writing techniques that specifically accommodated the acoustics of the voice.[13] Subsequent generations of singers may not have been able to benefit as much from Wagner's acoustical accommodations due in part to the expansion of the orchestra, the enlarged size of performance venues, and the increased volume of the orchestra.

Shawe-Taylor contends that modern-day audiences have "grown accustomed" to a more "massive and forceful" orchestra than what was available to Wagner's contemporary sopranos.[14] Shawe-Taylor adds that beginning in Wagner's lifetime, opera houses "have increased remorselessly in size," so much so, that a 3,000-seat house has become the norm. The increase in theatre size has directly impacted vocal demands, in favor of "weightier timbres, more brilliant

[9] Ibid., 16.
[10] Howlett, 39.
[11] Shawe-Taylor, 17.
[12] Ibid., 22.
[13] Ibid., 21.
[14] Ibid., 21-22.

upper registers, and more sonorous low notes and greater volume in general," with no regard for the "consequent damage to promising young voices."[15] Shawe-Taylor appears to reject the notion that there is a "distinct species" who is singularly capable of performing Wagnerian operas. Also, Shawe-Taylor urges musicians to consider Wagner's "well-attested vocal preferences" in order to avoid the "bad vocal consequences...that seemed to derive from...singing his works...in the theatre."[16]

William R. Braun offers that a way to combat the "bad" consequences is by gaining knowledge of "what the composer actually wrote."[17] In Wagner's case, we not only have to consider the music that he wrote, but also what he wrote *about* music. In his essay, *On the Performing of Tannhäuser* (1852), Wagner wrote that "the music must be subordinate to the drama, singers should take liberties with the rhythms so the vocal line has a more natural flow." In *The Artwork of the Future* (1849), Wagner expressed his ideas that Beethoven was the highest musician, that Shakespeare was the best writer, and that Wagner himself was the synthesis of the two. His statement "my declamation is song; and my song declamation," highlights that Wagner put specific emphasis on dialogue. According to Donald J. Grout, Wagner almost considered becoming a playwright. In his operas, Wagner was able to combine his talent for writing with his talent for composing, whereby the orchestra exists only to supplement the text, like a play set to music.[18]

According to Howlett, Wagner's "dual role as librettist and composer combined to direct his concentration towards the melodic expression of the text."[19] Barry Millington expands on

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[15] Ibid., 18.
[16] Ibid., 16-17.
[17] William R. Braun, "Settling the Score," in *Opera News,* 30.
[18] Donald J. Grout, "*The Operas of Wagner*." In *A Short History of Opera.* New York: Columbia University Press, 1965.
[19] Howlett, 38.

Howlett's point by stating the text setting of Wagner's 'art-work of the future' "may represent the most fundamental of Wagner's innovations."[20] Millington also makes the case that Wagner's primary concern "was that the all-important text should be projected intelligibly." With an emphasis on intelligibility, Wagner "developed a new kind of vocal line that faithfully reflected the verbal accentuation, poetic meaning and emotional content of the text." Additionally, Wagner tailored the musical setting to the demands of the text, in direct opposition to the "regularly phrased melodies of Berlioz and Meyerbeer.[21] According to his ideals laid out in *Oper und Drama,* Wagner set his text "with natural word stresses and to a melodic line that registers every nuance while remaining musically interesting in its own right."[22]

One mechanism that Wagner used to help the sopranos to be better understood, and to decrease the effort necessary for them to sing his music-text, was his use of conscious or unconscious vowel-pitch matching. The process of vowel-pitch matching involves matching the frequencies of vowels as identified by formants with the frequencies of pitches. Formants (F1 and F2) allow vowels to be understood in speech and singing. Sopranos can "tune" F1 to the fundamental pitch (f_0). If f_0 is higher than F1, sopranos must modify the vowel to achieve uniformity of tone. In other words, the soprano can tune the first formant to match the pitch of a given note. However, when vowels are modified, intelligibility decreases. Because Wagner wrote his own libretti, it was important to him that the words be understood; the intelligibility was just as important as the music. With that in mind, he would have been able to adjust the notes to accommodate the singers so that the words would have been more intelligible.[23]

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[20] Barry Millington, "Wagner's revolutionary musical reforms," in *Wagner's Ring of the Nibelung*, eds. Stewart Spencer and Barry Millington, 14-16. New York: Thames and Hudson Inc., 1993, 15.
[21] Ibid., 14.
[22] Ibid.
[23] John Smith and Joe Wolfe, "Vowel-pitch matching in Wagner's operas: Implications for intelligibility and ease of singing," 1.

Smith and Wolfe showed in their study that Wagner assisted vowel-pitch matching in the roles of Brünhilde and Isolde, and that Wagner's vowel distribution varied systematically with pitch. Compared to soprano roles in operas by Mozart, Rossini, and Strauss, Wagner "aided the acoustics of the soprano voice," much more.[24] According to Smith and Wolfe's results, Wagner not only purposefully matched vowels to pitch in order to enhance declamation, but also there was a systematic increase of vowel-pitch matching as he gained experience as a composer.

The present study was undertaken to validate Smith and Wolfe's findings that Wagner's preference for vowel-pitch matching increased as he gained experience as a composer. The methodology employed followed the same procedures outlined by Smith and Wolfe to ensure comparability. Using the Dover editions of *Der Fliegende Holländer* (1840) and *Parsifal* (1882), the vowels and pitch frequencies (f_0) were recorded for each note sung in the soprano roles of Senta and Kundry. A total of 1,419 vowel sounds were recorded for Senta, and 1,368 vowel sounds were recorded for Kundry. The female F1 values were recorded and compared to the pitch frequencies. Senta's "jo ho hos" and Kundry's "Ha ha!s" were not taken into consideration, as no textual information is offered. Diphthongs were categorized according to the beginning sound, as that is the vowel that is sung for the longest period of time. Hertz (Hz) per jaw height were determined by the lower and upper quartile (Fig. 1), based on the Pätzold and Simpson chart of German vowels, and were categorized by jaw height: closed (250-500 hz), half-closed (350-550 hz), half-open (450-700 hz), and open (600-1,000 hz).[25]

[24] Ibid.
[25] Matthias Pätzold and Adrian P. Simpson, "Acoustic analysis of German vowels in the Kiel Corpus of Read Speech" *Arbeitsberichte des Instituts Für Phonetik und Digitale Sprachverarbeitung Universität Kiel* (1997), accessed April 15, 2018, http://www.ipds.uni-kiel.de/kjk/pub_exx/aipuk32/mpas.pdf.

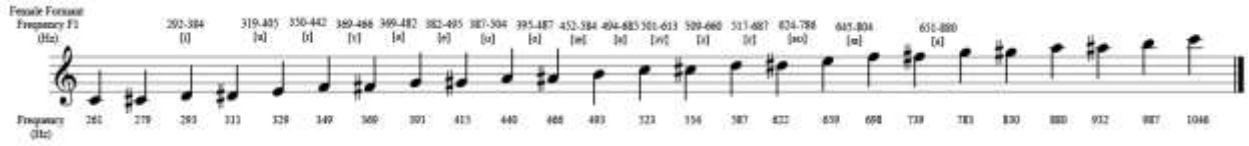

Fig. 1 Vowels with upper and lower quartile frequencies of female F1 in Hertz, in relation to pitch frequencies, represented on the staff.

In order to identify if there was a preference for vowel-pitch matching, statistical analysis was completed using the γ parameter as defined by Smith and Wolfe: γ=g/h-1; "where g represents the average fraction of notes within a particular frequency band whose vowel corresponds to that jaw height, and where h represents the average fraction of notes at all other frequencies having those vowels."[26] An examination of the extent of vowel-pitch matching in Wagner's soprano roles, Senta and Kundry, revealed a negative or unfavorable preference for both roles at the open-end of jaw height range; γ=-0.44 and γ=-0.73, respectively, and a favorable preference for half-open vowels; γ=0.3 and γ=0.18, respectively (Fig 2). These findings for Senta and Kundry contrast with the results from Smith and Wolfe. According to Smith and Wolfe, the best range for vowel-pitch matching for Brünhilde and Isolde were the vowels with open jaw heights. Also, Smith and Wolfe found that for Isolde, there was an unfavorable preference for vowel-pitch matching in the half-open category.

The findings of the present study may be attributed to a greater frequency of low notes in these scores by comparison to Wagner's other works. For example, the tessitura of Kundry's role is lower than that of Senta, Brünhilde, and Isolde, so pitches near the top of the staff (where open-vowels achieve the best resonance) are less likely to appear in the score. Fig. 3 visually represents how often Wagner wrote each pitch, which shows his preference for notes on the staff

[26] John Smith and Joe Wolfe, "Vowel-pitch matching in Wagner's operas: Implications for intelligibility and ease of singing," 3.

for both Senta and Kundry. It is important to note that the most common note that Wagner wrote for both roles was D5 (587 hz) (Fig. 3). The vowel jaw-height category that corresponds with that frequency is half-open, which yielded a positive gamma for both roles. Therefore, Wagner did write consistent vowel pitch-matching in the middle of the staff, which is where most of the textual information occurs.

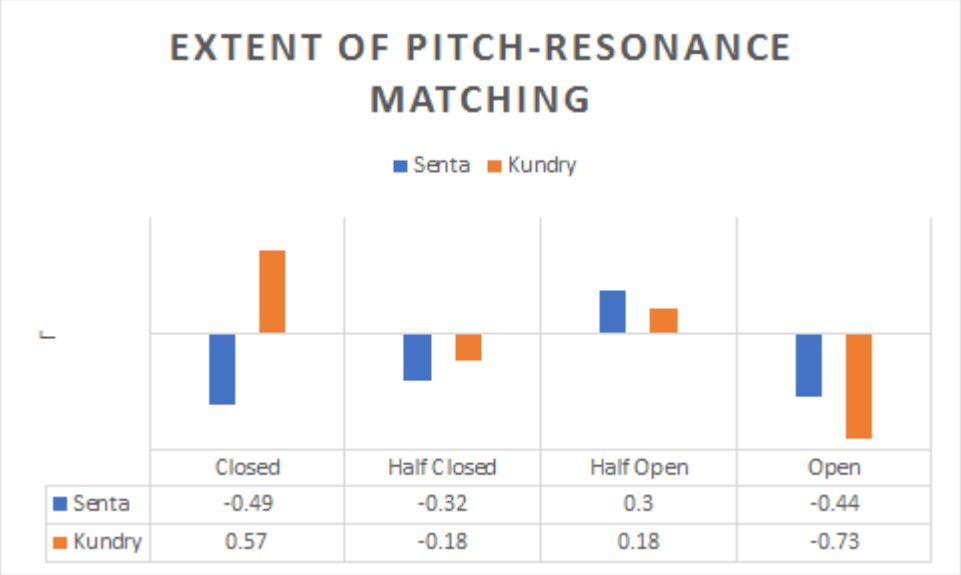

Fig. 2 The extent of pitch-resonance matching for Senta and Kundry. The degree of matching is indicated by γ, a parameter that indicated the preference for the appropriate vowel-pitch combinations. Positive and negative values of γ indicate favorable and unfavorable pitch-resonance matching, respectively.

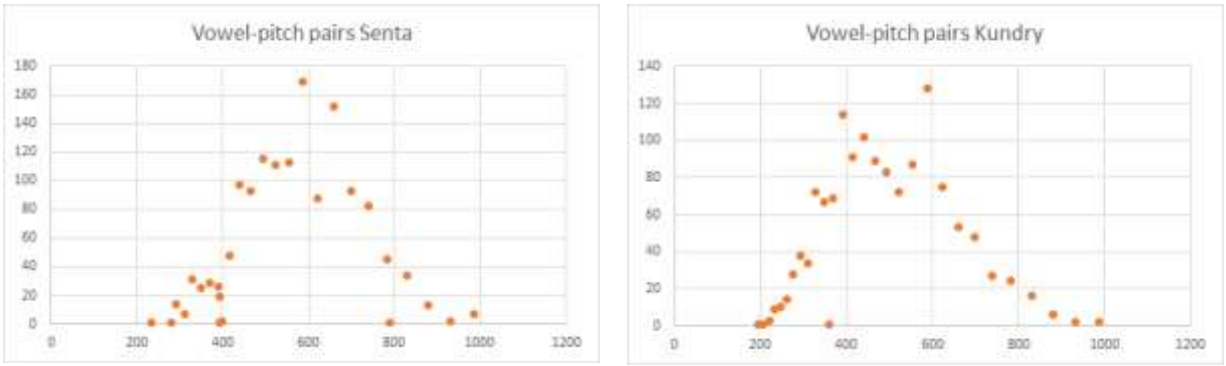

Fig. 3 The scatter chart plots the number of vowel-pitch combinations as a function of written pitch frequency f_0 for Senta and Kundry. The X-axis represents pitch frequencies and the Y-axis represents the number of times the pitch was written by Wagner.

The present findings coincide with the initial hypothesis that Wagner's earlier works would exhibit a less developed preference for vowel-pitch matching in soprano roles than would be found in his later works. For all jaw heights in Senta's role, there was unfavorable vowel-pitch matching, except for the half-open jaw height where there was a slight preference. Additionally, the present findings do not coincide with the hypothesis that Wagner would demonstrate a greater fidelity to vowel-pitch matching in his later work for sopranos than was found in the roles of Isolde and Brünhilde. It is surprising that in Kundry's role there was unfavorable vowel-pitch matching in both the half-closed and open vowels. One limitation of the present study is that the roles of Senta and Kundry only provided 3,000 vowel-pitch combinations to examine. Therefore, there was a greater likelihood for Smith and Wolfe to see a preference for vowel-pitch matching, if one existed, because they collected over 10,000 vowel-pitch combinations.

According to the results of the present study, Wagner did utilize vowel-pitch matching for the closed vowels and half-open vowels in Kundry's role. However, the unfavorable vowel-pitch matching for the other vowel categories may be attributed in part to differences in how Wagner composed *Parsifal*, his last opera, compared with his earlier works. For example, in composing *Parsifal*, Wagner appeared to revert to an earlier style found in French Grand Opera, which included choruses and duets. This style may have influenced how he set Kundry's role, thereby explaining the less sophisticated acoustical considerations for the open vowels. Also, Wagner's approach may be different from his other works because he was able to write *Parsifal* after he observed the *Ring* cycle at the Bayreuth Festspielhaus, which he designed. With a better understanding of the acoustics of his own theatre, Wagner may have taken measures to

emphasize certain ranges of the voice to enhance intelligibility based on what he heard in the *haus.*

Based on the results of the present study, there are pedagogical implications. Wagner's vowel-pitch matching may be more important now, than it was even in his lifetime, due to the added burden of the larger orchestras and expanded size of performance venues. If performers want to be true to Wagner's works, then musicians need to be more consistent with performance practices of his time. Modern day practices that have become widespread, have contributed to overwhelming Wagner's careful consideration for text-setting. Given that most performances of Wagner's music-dramas cannot take place at Bayreuth, conductors and opera houses need to consider the sonic authenticity that is sacrificed when the works are taken out of context.

Even if Wagner's text setting does not contain vowel-pitch matching across the board, the composer still paid special attention to the acoustics of the voice in his writing and his theatre design. He did not invent a new "species" of singer for his operas, but the music world at large forced the category of the "Wagnerian singer" onto singers, and many capable voices have been left out of the repertoire. Based on Wagner's preference for the italianate style with clear diction and the way he set his music, it does not appear that his aim was to exclude capable singers, as is today's common practice.

A likely next step for further research would be to collect all of the vowel-pitch combinations across all of the soprano roles in Wagner's operas for comparison. Additionally, it would be interesting to determine if Wagner was consistent in his practice for incorporating vowel-pitch matching for the other voice types in his operas. Based on the strong emphasis that Wagner placed on the intelligibility of his libretti, it is highly likely that he would have incorporated techniques to enhance this quality for other voice types. It makes sense for initial

studies to examine the soprano roles because of the ease in identifying resonance tuning using the first formant. In order to proceed with additional studies, a new methodology to examine other voice types in Wagner's operas must be developed, based on how those singers accomplish resonance tuning. Once the frequency of vowel-pitch matching has been recorded for all roles in Wagner's *oeuvre*, applying the same examination techniques to other composer/librettists' works would also be valuable for comparative purposes.

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